POWER ELECTRONICS

Code: 322037

Main Scientific Area: Electronics and hardware

Lecturer: Rui Paulo Freitas de Sousa Mendes

Language of Instruction: Portuguese

Regime: S1

Contact Hours: 60h Total Workload: 108h

ECTS: 6,0

Objectives

It is intended to convey to the student knowledge about the action of power electronics converters in controlling the flow of electrical energy between different types of sources (ac and dc) and different types of electrical loads, such as in activating electrical machines (ac and dc), switched power supplies and in renewable energy systems, among others.

Learning Outcomes

At the end of this curricular unit, students should know how to distinguish natural commutation converters from forced commutation converters and analyze the operation of AC-DC, DC-AC, DC-DC and AC-AC converters. For a given specific application, students should know how to select the most appropriate converter and select the most suitable semiconductors.

Course Contents

1. Overview of devices used in power electronics: semiconductor devices and passive components
2. AC-DC Converters
2.1. Uncontrolled rectifiers.
2.2. Semi-controlled and fully controlled rectifiers.
2.3. Current Total Harmonic Distortion and Power Factor in non-linear loads.
3. DC-DC Converters.
3.1 Introduction, technologies, topologies and power levels.
3.2 Non-isolated topologies
3.3 Isolated topologies
4. DC-AC Converters
4.1. Half-bridge and full-bridge single-phase inverters.
4.2. Modulation Strategies
4.3. three-phase inverters.
5. Applications, Modeling and simulation of power converters.

Recommended Bibliography

Mohan, N., Undeland, T. M., Robbins, W. P. (2002). Power Electronics: Converters, Applications, and Design (3rd ed.).
Wiley. Rashid, M. (2013). Power Electronics: Circuits, Devices Applications (4th ed.). Pearson.

Learning and Teaching Methods

The main learning objective of this curricular unit is to provide students with technical knowledge about energy conversion through power converters, including understanding the main conversion topologies, their applications, as well as design and control techniques.

Assessment Methods

Test 50%
Practical research and development work 50%
Minimum grade in each of the components 10 Val.